UDC 504.06

THE AIR HEATER OF THE HOUSEHOLD GAS COOKER FOR HEAT AND AIR SUPPLYING OF KITCHENS IN THE RESIDENTIAL BUILDINGS WITH RAISED HEAT-SHIELDING AND GERMETICAL EXTERNAL PROTECTIONS

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The article deals with the creation of a heat exchanger that allows more efficient use of the energy from gas combustion for heating and supplying fresh outdoor air to ventilated kitchens to ensure optimum technological gas combustion and controlled air exchange in terms of microclimate comfort with the possibility of their installation in the operated buildings without significant capital costs.

Introduction. The imperfection of technology for the use of fuel and energy resources in the urban development sector and in the municipal and domestic sector of the economy, consuming more than a third of all solid, liquid and gaseous fuels and electricity, is burdensome for the entire national economic complex of the Republic of Belarus, which imports most of it, energy intensity of the gross national product and significantly reduces the competitiveness of the products. In this regard, further improvement of the engineering systems of heat and gas supply and air supply of buildings with external fences of increased thermal protection and tightness, directed to energy and resource saving in comfortable living conditions, is one of the most important directions of the state programs of scientific research of the Republic of Belarus.

The thermal ventilation of gasified kitchens is designed to create an air-exchange process inside residential s buildings with the function of heating the fresh air. The device is intended for the heat-air supply of kitchens in residential and civil buildings with external fences of increased tightness.

Body. The gas cooker [1] with the tubular heat exchanger built in the design of a wall which application is possible only in a new building is known. Besides such design of the heat exchanger under the scheme «a pipe in a pipe» has not developed enough surface of heat exchange and consequently has low efficiency of the use of warmth of leaving top internal gases for heating supply external ventilating air not exceeding $\eta = 27$ %.

The improvement problem is to create such a heat exchanger that would allow using warmth from burning gas for heating and giving fresh external air in the ventilated premises of kitchens with more efficiency for maintaining optimum technological burning of gas and normalised air exchange parametres of microclimate comfort. It is also important to consider the installation of the heat exchanger in buildings without considerable capital expenses.

The air heater of a gas cooker is executed as a separate device of a compact design with the height not exceeding the height from the floor to the ceiling of a kitchen premise, depth *in* = 0,1 m, and width to equal width of a gas cooker, i.e. *and* = 0,5 ÷ 0,6 m.

Air heater of a gas cooker allows using the warmth from burning gas not only for cooking, but also for providing fresh external air oxygen at its self-adjustable supply in necessary quantity, proportional to the amount of burnt gas used with its simultaneous heating for the account of the secondary power resources containing in the deleted products of burning gas.

Wide application of the proposed gas cooker heater in town planning will allow to lower power consumption for heating buildings. As according to the scheme applied all around CIS countries, using a gas cooker or a gas water heater in a gasified building stipulates opening window leaves with air supply. It is indispensable for the maintenance of gas burning technology and the assimilation of the combustion products to the regulated values of maximum-permissible concentration (maximum concentration limit) with their subsequent removal through the exhaust channels of ventilating systems.

Such technology of ventilation of the installed gas buildings leads to overcooling of these buildings in a cold season and to unjustly overestimated consumption of thermal energy spent on heating the premises and heating the external cold air that permeates through window leaves and reduces comfortable microclimate parametres complying with sanitary-and-hygienic requirements.

In fig. 1 is the longitudinal section of a gas cooker air heater, in fig. 2 – type on B-B, in fig. 3 – type on A-A.

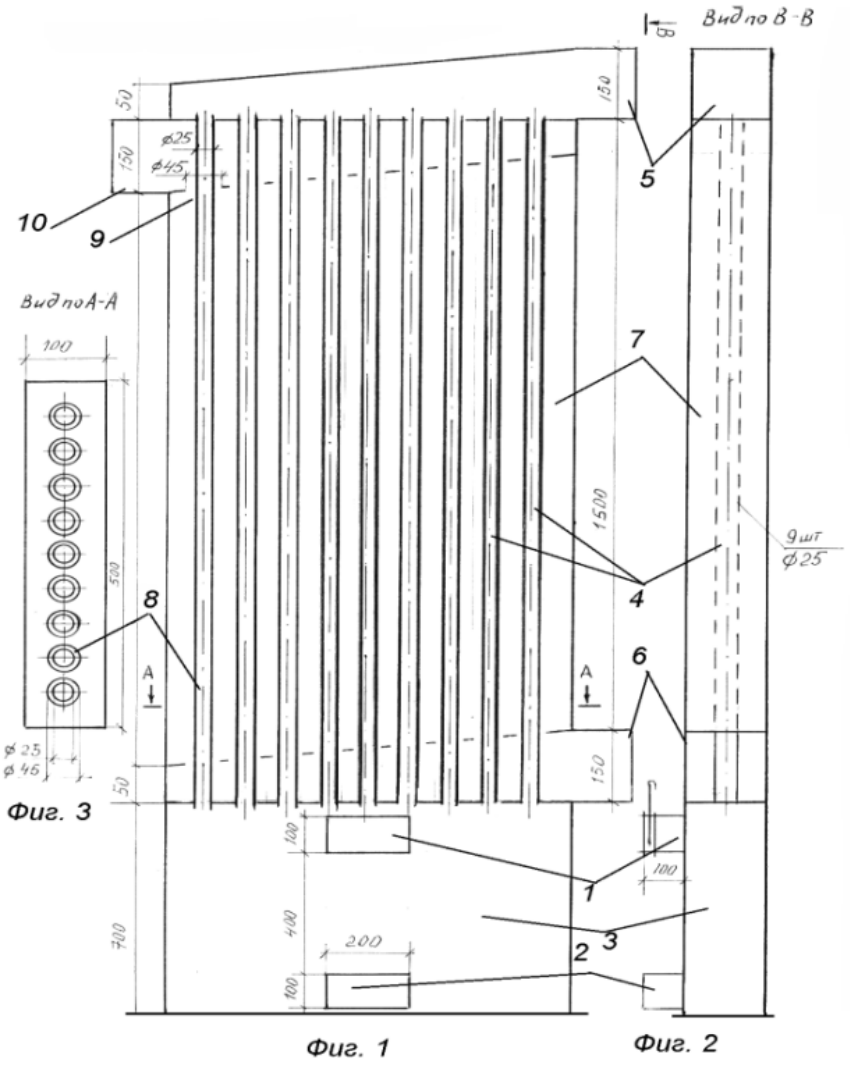

Fig. 1. A heat exchanger of a gas cooker

The air heater of a gas cooker represents a heat exchanger implemented in the form of a parallelepiped with overall dimensions of width, depth and height 0,5 x 0,1 x 2,5 m, set into vertical position between the gas cooker and the wall surface. The devise consists of the inlet branch pipe for the gas combustion products top 1 and bottom 2, the reception chamber 3, heat-exchange tubes 4, the chamber for the cooled heating heat-carrier with a target branch pipe 5, a branch pipe 6 for the external cold air input, the intertube chamber 7 with bottom 8 and the top 9 apertures for admission and release of heated up air and a branch pipe 10 for the output of fresh external warmed-up air into the premise.

The air heater of a gas cooker works in the following way:

At burning of gas tap the combustion products from the cooker make through the top 1 and the bottom 2 entrance branch pipes of the air heater of a gas cooker. The mix of gas-burning products and exhaust air with the temperature of about t = 120 ÷ 350 °C arrives at the reception chamber 3, from where in regular intervals it is distributed to the tubes 4 and under the influence of exhaust ventilation rises upwards, exchanging warmth with washing their external surface outside air. The air is supplied in regular intervals through the branch pipe 6 and bottom ring apertures 8 into the intertube chamber 7, from where through the top ring apertures 9 and the branch pipe 10 it gets to the top zone of the ventilated premise of the kitchen.

Thanks to the advanced design of the heat exchangers with actively developed heat-exchange surface the heat removal reaches values of η = 62 ÷ 78 % depending on the burnt gas discharge rate and the heat-exchange mode.

More detailed theoretical propositions are presented in [2].

Executed heat engineering and aerodynamic calculations have allowed defining the optimum constructive sizes of the air heater of a household gas cooker, which are represented in fig. 1-3.

Conclusion:

1. Theoretical bases of calculation of the recuperative heat exchanger of a gas cooker on the basic criterial dependences of the physical processes similarity theory of heat exchange have been developed at heating of ventilating external air by leaving the warmth of gas burning products at variable temperature and aerodynamic modes.

2. The technique of experimental research has been developed. It is aimed at specifying the laws of the change of the heat effect intensity of the direct-flow heat exchanger working under the scheme «pipe in pipe» by using the calculation method on dimensionless complexes for defining the final temperatures of heat exchange environments on two experimentally certain temperature values of heated up and heating heat-carriers.

3. The results of the complex theoretical and experimental research analysis have been taken as the principle of the design procedure and the further perfection of the designs of recuperative heat exchangers with the peak efficiency of using the warmth of top internal gases.

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